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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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TITLE: METHOD AND DEVICE FOR OPTICALLY TESTING SEMICONDUCTOR ELEMENTS

AMENDED CLAIMS

1. (currently amended) A method for optically testing semiconductor components ~~(12)~~ of a certain thickness ~~(L)~~ by using an optical interference system with at least one light source (1) for emitting a monochromatic light beam ~~(2)~~ having a wavelength ~~(□)~~, for which the material of the semiconductor component ~~(12)~~ is at least partially transparent, wherein the light beam ~~(2)~~ is split into a reference beam ~~(15)~~ and a sample beam ~~(16)~~, the sample beam ~~(16)~~ is directed towards the semiconductor component ~~(12)~~ and, with the help of a detection system ~~(41)~~, the images produced by interference of the light beam ~~(20)~~ reflected by the semiconductor component ~~(12)~~ with the reflected reference beam ~~(25)~~ are recorded for a two-dimensional illustration of certain internal physical properties of the semiconductor component ~~(12)~~, wherein the sample beam ~~(16)~~ is directed at the backside ~~(18)~~ of the semiconductor component ~~(12)~~ to be tested and reflected at its topside (~~23~~), and at least two interference images are detected in temporal sequence under different states of stress of the semiconductor component ~~(12), characterized in that~~, wherein the coherence length ~~(L_{Coh})~~ of the light beam ~~(2)~~ split into the sample beam ~~(16)~~ and the reference beam ~~(15)~~ is shorter than the optical path length 2.L.n of the semiconductor component ~~(12)~~ to be tested, where L is the thickness and n is the mean refractive index of the material of the semiconductor component ~~(12)~~.

2. (currently amended) A method according to claim 1, ~~characterized in that~~ wherein the diameter of the sample beam ~~(16)~~ is adjusted to the area of the

semiconductor component ~~(12)~~ to be investigated.

3. (currently amended) A method according to ~~any one of claims 1 or 2, characterized in that~~ claim 1, wherein the detected interference images are stored.

4. A method according to ~~any one of claims 1 to 3, characterized in that~~ claim 1, wherein the different states of stress are caused by the excitation of the semiconductor component ~~(12)~~ with at least one external stress, by which the certain properties of the semiconductor component ~~(12)~~ are influenced, and that at least one light beam ~~(2)~~ is emitted during the stress and a corresponding interference image is detected.

5. A method according to claim 4, ~~characterized in that~~ wherein the external stress is caused by high voltage or high power pulses.

6. A method according to claim 4, ~~characterized in that~~ wherein the external stress is caused by flashes of light.

7. A method according to ~~any one of claims 4 to 6, characterized in that~~ claim 4, wherein several light beams ~~(2)~~ are emitted before, during and/or after the stress and the corresponding interference images are detected.

8. (currently amended) A method according to ~~any one of claims 4 to 7, characterized in that~~ claim 4, wherein the stress is detected and at least one light beam (~~2~~) is triggered at a pre-defined time ~~(t_D)~~ after the detection of the stress.

9. (currently amended) A method according to ~~any one of claims 4 to 6, characterized in that~~ claim 4, wherein a light beam ~~(2)~~ is emitted at least during the stressed state, and several interference images are detected before, during and/or after the stressed state.

10. (currently amended) A method according to ~~any one of claims 4 to 9, characterized in that~~ claim 4, wherein the backside ~~(18)~~ of the semiconductor component (~~12~~) is polished before optical testing.

11. (currently amended) A method according to ~~any one of claims 1 to 10, characterized in that~~ claim 4, wherein the interfering light beams are split, and the

split partial beams are recorded by individual detection systems ~~(41)~~.

12. (currently amended) A method according to claim 11, ~~characterized in that~~ wherein the detection system ~~(41)~~ is activated in dependence on the emitted light beams.

13. (currently amended) A method according to claim 11 ~~or 12, characterized in that~~, wherein the emitted light beams ~~(2)~~ have different polarizations, preferably orthogonal polarization.

14. (currently amended) A method according to ~~any one of claims 11 to 13, characterized in that~~ claim 11, wherein the emitted light beams ~~(2)~~ have different wavelengths.

15. (currently amended) A method according to ~~any one of claims 1 to 14, characterized in that~~ claim 1, wherein the reference beam ~~(15)~~ is reflected at a reference semiconductor component, wherein the reference semiconductor component is identical with the semiconductor component ~~(12)~~ to be tested.

16. (currently amended) A method according to ~~any one of claims 1 to 15, characterized in that~~ claim 1, wherein the intensity of the reference beam ~~(15)~~ is attenuated.

17. (currently amended) A method according to ~~any one of claims 1 to 16, characterized in that~~ claim 1, wherein the position of the reflected reference beam ~~(25)~~ is changed, ~~e.g. by tilting the reference mirror,~~ so as to optimize the interference image.

18. (currently amended) A method according to ~~any one of claims 1 to 17, characterized in that~~ claim 1, wherein the interference images are automatically compared to each other.

19. (currently amended) An arrangement for optically testing semiconductor components ~~(12)~~ of a certain thickness ~~(L)~~ with at least one light source ~~(1)~~ for emitting a monochromatic light beam ~~(2)~~ having a wavelength for which the material of the semiconductor component ~~(12)~~ is at least partially transparent, and with a

beam splitter ~~(8)~~ for splitting the light beam ~~(2)~~ into a reference beam ~~(15)~~ and a sample beam ~~(16)~~, and with at least one detection system ~~(41)~~ for recording the two-dimensional images produced by the interference of the light beam ~~(20)~~ reflected by the semiconductor component ~~(12)~~ with the reflected reference beam ~~(25)~~, wherein the backside ~~(18)~~ of the semiconductor component ~~(12)~~ faces the sample beam ~~(16)~~, ~~characterized in that~~, wherein a stressing device ~~(74)~~ for emitting an external stress for the semiconductor component ~~(12)~~ is provided, and that furthermore a memory ~~(81)~~ whose input side is connected to the output of the detection system ~~(41)~~ for storing at least two interference images recorded at time intervals, and a device ~~(133)~~ whose input is connected to the output of the memory ~~(81)~~ for automatically comparing the interference images under different stresses are provided.

20. (currently amended) An arrangement according to claim 19, ~~characterized in that~~ wherein a device for adjusting the diameter of the emitted light beam ~~(2), e.g. a beam expander (5),~~ for enlarging the diameter is arranged in front of the light source ~~(1)~~.

21. (currently amended) An arrangement according to claim 19 ~~or 20, characterized in that~~ the stressing device ~~(74)~~ is connected with a device ~~(76)~~ for controlling the light source ~~(1)~~.

22. (currently amended) An arrangement according to claim 21, ~~characterized in that~~ wherein the control device ~~(76)~~ comprises a delaying device.

23. (currently amended) An arrangement according to ~~any one of claims 19 to 22, characterized in that~~ claim 19, wherein the detection system ~~(41)~~ comprises a beam splitter ~~(126)~~ for separating the light beams into individual light beams with different light parameters and one camera ~~(22)~~ each for recording images of these individual light beams.

24. (currently amended) An arrangement according to claim 23, ~~characterized in that~~ wherein the beam splitter ~~(126)~~ comprises a polarizing device ~~(166)~~ for separating the light beams into individual light beams with different polarization.

25. (currently amended) An arrangement according to claim 23 or 24, ~~characterized in that~~, wherein the beam splitter ~~(126)~~ comprises dichroic beam splitters ~~(189)~~ for splitting the light beams into individual light beams with different wavelengths (□).

26. (currently amended) An arrangement according to ~~any one of claims 19 to 25, characterized in that~~ claim 19, wherein a collimator ~~(10)~~ is arranged upstream of the semiconductor component ~~(12)~~ for parallel adjustment of the sample beam ~~(16)~~.

27. (currently amended) An arrangement according to ~~any one of claims 19 to 26, characterized in that~~ claim 19, wherein an attenuator ~~(26)~~ is arranged in the path of the reference beam ~~(15)~~.

28. (currently amended) An arrangement according to ~~any one of claims 19 to 27, characterized in that~~ claim 19, wherein a device for changing the position of the reflected reference beam ~~(25)~~ is provided which is formed by a device for tilting the reference mirror ~~(24)~~.

29. (currently amended) An arrangement according to ~~any one of claims 19 to 28, characterized in that~~ claim 19, wherein the device ~~(133)~~ for automatically comparing the interference images recorded in temporal sequence is formed by a computer ~~(80)~~.

30. (currently amended) An arrangement according to ~~any one of claims 19 to 29, characterized in that~~ claim 19, wherein the light source ~~(1)~~ is formed by a laser.

31. (currently amended) An arrangement according to ~~any one of claims 19 to 30, characterized in that~~ claim 19, wherein the detection device ~~(41)~~ includes a camera ~~(22)~~, e.g. a vidicon or CCD camera.

32. (currently amended) An arrangement according to ~~any one of claims 19 to 31, characterized in that~~ claim 19, wherein the detection device ~~(41)~~ includes a two-dimensional multi-element detector.

33. (new) A method according to claim 17, wherein the position of the reflected reference beam is changed by tilting the reference mirror.

34. (new) An arrangement according to claim 20, wherein said device for adjusting the diameter of the emitted light beam is a beam expander.

35. (new) An arrangement according to claim 31, wherein said camera is a vidicon camera.

36. (new) An arrangement according to claim 31, wherein said camera is a CCD camera.